

REPELLENTS AGAINST LAND LEECHES FOR MILITARY USE

T. KOSHY

Institute of Nuclear Medicine and Allied Sciences, Delhi

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A short account of the habits and nature of depredations of the leeches in the Himalayan region is given. The requirements for a leech repellent, to be of use in a hot humid and rainy area are stressed. A brief survey of the repellents and the need for their suitable screening for use in this area is made. Mention is made of some newer insect and mite repellents, which are likely to prove leech repellents as well.

It is suggested that emphasis should be made on the choice of a cloth impregnated repellent for military use in the area rather than on a 'skin repellent.

Leeches are sanguivorous annelids. It is probable, that for land leeches blood from their hosts is the only diet and that one blood meal is sufficient for the year^{1,2}. However, their "unutterable yearning" for blood and their "leechy nature" to hold on to the host at any cost, is well-known. Blood may continue to flow from the sites of bites for many hours³. Uncontrolled bleeding from multiple abandoned sites of bites have been known to produce sufficient loss of blood to cause death some times⁴. Ulcers may develop which incapacitate a man for considerable time. They may enter through any orifice of the body and get lodged inside. In certain places, in forest, they could be so numerous as to make them unapproachable to man or beast. They are capable of penetrating finely woven stockings and lace holes of boots and shoes; they ascend over the surface of trousers and other wearing apparel until a way to the skin is found. Owing to this peculiar habit, any part of the body may be subject to attack.

Many places in the Himalayan are subject to intense leech depredations. They cause serious inconvenience particularly to troops while at camps or on the move and make the army mules bolt and disrupt supplies and communications. Their favourite resorts are the damp bed of the forests. The northern border, particularly the north-east border is a dense ever green forest with heavy annual rainfall and the area is heavily infested by many species of leeches. The hot and humid conditions are unfavourable for the application of any known type of repellent on the body. Not only they cause discomfort but are also easily washed away by perspiration and rain. In a terrain of deep ravines and steep hills of thick forest with impenetrable undergrowth, they are not approachable for control, operations with any leechicide. An effective leechicide too, has not yet been reported. Hardly anything is known of their habits and habitat. By the first monsoon rains in the month of May, they make their appearance in this area and are seen as late as September or October. Where they survive during winter and the dry season, is still a matter for conjecture. This makes the use of repellents however the only alternative method of protection and the study on repellents a necessity.

REQUIREMENTS OF A LEECH REPELLENT

Any repellent will be required to be stable in a hot and humid climate, capable of not being washed away by rain or perspiration, easy to apply and free from unpleasant odours and toxic effects. It should also be economical and easily available. An insect repellent

is not necessarily a leech repellent. A repellent effective against both is highly desirable as the area also abounds with biting flies, mosquitoes, sand flies, ticks, mites and other noxious insects. Any repellent will need to have a residual effect of 12 hours or more to be of use. It could be hardly expected to do periodical application of the repellent on the body while men are at work or on the move.

LEECH REPELLENTS

Lemon, carbolic acid and tobacco leaves have been reported from as early as 15th century onwards to repel leeches. Other substances such as salt, camphor, naphthalene and various aromatic and essential oils are also known to have this property. They could be formulated in forms in which the base is made as a vanishing cream or vaseline. They are easy to prepare but not likely to be suitable. The vanishing creams are easily removed by perspiration and rain while the latter will not be liked to apply a sticky greasy preparation of this nature on the skin in hot humid atmosphere.

The subject has not been under serious study. The leeches are not important as vectors of diseases and they are denizens of tropical and semitropical forests only. So, very little attention has been given to the problem. They became the object of interest during the last war when troops were employed in the jungles of South-East Asia and Burma. Recently relative repellency of various chemicals against leeches, have been a subject of study^{5,6,7}.

Stammers⁵ tested about 75 chemicals and found the following substances promising.

							In arachis oil
(i) hydroxycitronellal	..	..	..	..	..	..	1:100
(ii) dimethylphthalate	..	..	..	..	..	..	1:60
(iii) diethylphthalate	..	..	..	..	..	..	1:60
(iv) ethylhexanediol	..	..	..	..	..	..	1:60
(v) vanillin	..	..	..	..	..	..	1:60
(vi) nicotine	..	..	..	..	..	..	1:60

Hydroxycitronellal was found to be the best, both for greater repellency and residual effect. It has a pleasant odour. But this chemical is not easily obtained in India and its toxic properties, if any, on human beings are not known. Among others, dimethylphthalate was found to be better for being equally effective against insects. Creams compounded with DMP as under also proved to be effective:

							Parts
(i) dimethylphthalate	..	..	..	..	..	..	25
white wax	..	..	..	..	..	..	18
arachis oil	..	..	..	..	..	..	57
(ii) dimethylphthalate	..	..	..	..	..	..	50
white wax	..	..	..	..	..	..	10
arachis oil	..	..	..	..	..	..	10
wool alcohol	..	..	..	..	..	..	30

(iii)	dimethylphthalate	..	..	..	..	..	50
	wool alcohol	..	..	..	..	..	50
(iv)	dimethylphthalate	..	..	..	..	..	25
	lanette wax	..	..	..	..	..	25
	white wax	..	..	..	..	..	15
	hard paraffin	..	..	..	..	..	15
	wool fat	..	..	..	..	..	20

Ribbands⁶ found that dibutylphthalate (a chemical in use with the army against mites) is ineffective against leeches and the DMP was superior to *Rutger's-612*, another insect repellent. Robert *et al.*^{7,8} tested the substance *M-1960* (equal parts of *n.* butyl acetanilide, 2-butyl-2 ethyl-1, 3 propanediol and benyl benzoate with 10% of emulsifying agent (Tween 80) against mites, mosquitoes and flies. It was found to be very highly effective against leeches both in repellency and residual effect. It is said to have no toxic effect on mammals.

CHOICE AND USE OF REPELLENTS

Most of these repellents as well as other insect repellents have not been tested against leeches in this country. It will be highly desirable to screen them and their formulations against as many species of leeches as are available in the area, under simulated natural conditions, for the selection of a suitable repellent for use by the troops. It is not enough for a chemical to be highly repellent but more important is, how long it is effective under hot humid conditions, perspiration and in rain. As yet there is no repellent, if applied on the body, which could give a lasting enough effect. Moreover it is difficult to persuade the use of any substance on the body which is likely to be irritant or greasy.

An alternative approach to the problem is to apply a thin effective dose of the repellent on a properly devised attire. The dress has to be so devised as not to give the leech accessibility to the body. This could be combination of well laced, well tongued boots, slacks and putties properly fitted. This could be easily done for the troops. From time to time leech gaiters have been devised. This consisted of thick material tied above or below the knee and closely approximating the shoe below. A number of the leeches could be warded off this way though it does not prevent them from climbing up the surface of the gaiters. But an attire properly impregnated with an effective repellent could dispense with such ungainly accoutrements as gaiters. It will also prevent leeches from travelling up the surface. The most readily and often attached areas are the legs and ankles. Boots and shoes are known to imbibe DMP readily and remain repellent for many days and protection was best secured by special attention in treating eyelets and upper margin. Persons wearing shoes impregnated with DMP were reported to have had complete protection from *Haemadyspa zeylanica* in Ceylon⁶. Insect repellents such as benzyl benzoate, DMP, *Rutgers-612* and *Indalone*, when applied to clothing, is known to retain repellency for considerably longer time against insects. *M-1960*, which is also proved to be a leech repellent has this virtue considerably better. It is not removed from clothing by normal washing procedures. On impregnation at 3.6g/sq. ft. it has been effective after several washes with soap and water⁹. DEET (*N, N*-diethyl-*m*-toluamide) now widely in use in America as an insect repellent, is also known to be resistant to rinsing with water but not as much as *M-1960*¹⁰. The effectiveness of DEET as an insect repellent led to the synthesis of other substituted toluamides. Of the many chemicals tested¹¹ only diethyl substituted compounds were effective against mosquitoes. The best tick repellents were

the *di-n*-dibutyl toluamides the *para* analog being effective for 70 days on clothes. It has been found in studies with homologous series of cyclohexane aliphatic acids and amides¹² that the initial repellency and residual effectiveness on cloth increased together, as the length of the structural chain increased up to a certain level and then decreased together.

A study on the relative merits of these chemicals as a repellent against leeches when impregnated on to clothing is likely to help in the choice and suitable use of a repellent for the troops in the hot humid climates of the Himalayan regions.

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